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THIRTY-EIGHTH ANNUAL REPORT

Fiscal Year Ending June 30, 1927

OF THE

Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

AUBURN

M. J. FUNCHESS, *Director*

AUBURN, ALABAMA

ALABAMA POLYTECHNIC INSTITUTE
COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

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EXPERIMENT STATION STAFF

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M. J. Funchess, M. S., Director of Experiment Station
W. H. Weidenbach, B. S., Secretary
P. O. Davis, B. S., Editor
M. E. Martin, Librarian

Agronomy	
M. J. Funchess, M. S.	Agronomist
F. W. Parker, Ph.D.	Soil Chemist
W. H. Pierre, Ph.D.	Associate Soil Chemist
J. T. Williamson, B. S.	Associate Agronomist
H. B. Tisdale, M. S.	Associate Plant Breeder
**J. W. Tidmore, M. S.	Assistant in Agronomy
W. H. Appleton, M. S.	Assistant in Agronomy
*W. W. Pate, M. S.	Assistant in Agronomy
J. F. Fudge, M. S.	Assistant in Agronomy
S. R. Worley, B. S.	Assistant in Agronomy
Animal Industry	
J. C. Grimes, M. S.	Animal Husbandman
John E. Ivey, M. S.	Poultry Husbandman
W. D. Salmon, A. M.	Assistant Animal Husbandman
Botany and Plant Pathology	
W. A. Gardner, A. M., Ph.D.,	Botanist
W. L. Blain, Ph.D.	Associate Plant Pathologist
*Martin Palmer, M. S.	Assistant in Botany
G. L. Fick, M. S.	Assistant in Botany
Chemistry (Agricultural)	
E. R. Miller, Ph.D.	Research Chemist
E. F. Williams, B. S.	Assistant Research Chemist
Economics (Agricultural)	
J. D. Pope, M. S.	Professor of Agricultural Economics
Engineering (Agricultural)	
M. L. Nichols, M. S.	Agricultural Engineer
*C. D. Miller, Ph.D.	Associate Agricultural Engineer
J. W. Randolph, M. S.	Assistant Agricultural Engineer
Entomology	
J. M. Robinson, M. A.	Acting Entomologist
H. G. Good, M. S.	Assistant Entomologist
F. E. Guyton, M. S.	Assistant Entomologist
F. S. Arant, B. S.	Assistant Entomologist
Farm Management	
J. F. Duggar, M. S.	Professor of Farm Management
Horticulture	
C. L. Isbell, M. S.	Acting Horticulturist
W. D. Kimbrough, Ph.D.	Assistant Horticulturist
R. W. Taylor, B. S.	Assistant Horticulturist
Veterinary Science	
C. A. Cary, B. S., D. V. M.	Veterinarian

CHANGES IN STATION STAFF

Appointments:	
J. F. Fudge, M. S.	Assistant in Agronomy
S. R. Worley, B. S.	Assistant in Agronomy
J. D. Pope, M. S.	Professor of Agricultural Economics
G. L. Fick, M. S.	Assistant in Botany
Resignations:	
W. W. Pate, M. S.	Assistant in Agronomy
Martin Palmer, M. S.	Assistant in Botany
C. D. Miller, Ph.D.	Associate Agricultural Engineer
Georgia W. Burton, Ph.D.	Research Professor in Home Economics

* Resigned during 1926-27
** On leave 1926-27

TRANSMITTALS

President Spright Dowell,
Auburn, Alabama.

Dear Dr. Dowell:

I have the honor to submit herewith the Thirty-eighth Annual Report of the Agricultural Experiment Station of the Alabama Polytechnic Institute.

Yours very truly,

M. J. Funchess,
Director.

Alabama Polytechnic Institute
Auburn, Alabama

Gov. Bibb Graves,
Montgomery, Alabama.

Dear Sir:

I take pleasure in transmitting to you the Thirty-eighth Annual Report of the Alabama Agricultural Experiment Station of the Alabama Polytechnic Institute.

Respectfully,

Spright Dowell,
President.

Good, H. G.—**Cotton Hopper Control.** *Journal of Economic Entomology* 19, No. 6. Page 869. During the summer of 1926, calcium-sulfo-cyanide was used for the control of the cotton hopper (Psallus seriatus Reut). Plots dusted with 5, 10, and 20 pounds per acre were used. Although 20 pounds per acre gave a more effective control, an application of 10 pounds per acre was most profitable. No burning of the foliage or injury to the plant was noticed.

Good, H. G., and Adkins, T. R.—**Notes on the Wintering Habits of the White-throated Sparrow (*Zonotrichia albicollis*).** WILSON BULLETIN. 39, pp. 75-78. The white-throated sparrow is a winter resident in the southern states and is found quite abundant all through the South. It feeds principally upon weed seeds and insects, especially ground beetles. With this sparrow is associated the chipping sparrow, vesper sparrow, and the slate-colored junco. It is most commonly found with towhee or chewink, as the white-throat always follows the towhee.

The white-throated sparrows are first seen in the vicinity of Auburn about the middle of October and remain until the beginning of May.

Pierre, W. H., and Parker, F. W.—**The Use of Collodion Sacks in Obtaining Clear Soil Extracts for the Determination of the Water Soluble Constituents of Soils.** *Soil Science*, 13; pp. 13-32. This paper reports the results of a study of the collodion sack method of preparing soil extracts. The procedure is given for preparing sacks and for using them in securing soil extracts. The method has several advantages over other methods that are in general use.

Pierre, W. H.—**Buffer Capacity of Soils and its Relation to the Development of Soil Acidity from the use of Ammonium Sulphate.** *Jour. Am. Soc. Agron.*, 19: pp. 332-351. A laboratory method of studying the buffer capacity of soils is given and the buffer capacity of a number of soils is reported. Greenhouse and field studies are reported showing the relationship between the buffer capacity of soils and the acidity developed from the use of ammonium sulphate as a fertilizer.

Randolph, J. W.—**Tractor Lug Studies on Sandy Soil.** *Jour. Am. Soc. Agricultural Engineers*, 8, No. 4, pp. 71-75. This describes field tests to determine the practicability of laboratory studies. The conclusions of laboratory studies were found to hold in the field and a formula for the design of lug equipment was developed.

Salmon, W. D.—**The Existence of Two Active Factors in the Vitamin B. Complex.** *Jour. Biol. Chem.* 73, pp. 483-497. Vitamin B is a complex containing at least two active substances. It is suggested that the term vitamin B be retained to designate the

complex, that the term vitamin B-P be used for the specific factor which prevents experimental beriberi, and that the other active fraction retain the name vitamin P-P unless further study proves that it is non-identical with the factor P-P of Goldberger and associates.

AGRONOMY

Rate of Fertilizing Cotton. (J. T. Williamson).—Sixty-seven cooperative tests on rate of fertilization were conducted during the year. The average results of four years of experimentation show that for cotton, nitrogen is the most needed element on Decatur, DeKalb, Cecil, Norfolk, Kalmia, Orangeburg, and Greenville soils. Phosphorus is the most needed element on Clarkesville and Oktibbeha soils. The results also show that the Auburn method of fertilizing cotton is as nearly correct as can be determined up to this time, and that a greater amount of fertilizer than the Auburn maximum may be profitable in some seasons.

Rate of fertilizing cotton following legumes. (J. T. Williamson).—During the past two years eight experiments have been conducted to determine what fertilizer should be used on cotton following a legume that has been turned under. As an average of the eight tests the most profitable fertilizer was six hundred pounds of acid phosphate and seventy-five pounds of muriate of potash. The addition of one hundred pounds of nitrate of soda to this fertilizer increased the yield of seed cotton only five pounds per acre. The response to nitrogen varied considerably in the different experiments depending on the amount of legume turned under. Where a satisfactory growth of vetch or other legume preceded the cotton there was no response to nitrate. If the legume made rather poor growth, one hundred pounds of nitrate of soda gave a profitable increase in yield.

Influence of time of planting vetch on growth. (W. H. Appleton).—Five plots of monantha vetch were planted on each of four different dates in the fall. In the spring the vetch was cut on five different dates. At each cutting one plot from each planting was harvested, its dry weight and nitrogen content were determined. The data secured are given in Table 1, following.

Table 1.—Yield and Nitrogen Content of Monantha Vetch as Influenced by Time of Seeding and Cutting

Planting date	Pounds dry matter per acre Date of cutting March 10	March 22	March 31	April 15	May 2
September 30	1,617	2,202	2,547	3,711	4,163
October 25	1,162	1,576	1,855	2,359	2,927
November 24	277	657	983	1,794	1,840
December 18	47	112	136	396	601

	Pounds nitrogen per acre				
September 30	65.2	73.8	89.4	112.9	110.3
October 25	41.6	53.7	58.4	72.2	71.7
November 24	11.5	24.0	39.5	62.8	51.0
December 18	1.8	4.2	5.5	14.0	15.6

These data show that the September 30th seeding produced the largest crop regardless of the cutting date. As the date of planting was delayed the crop produced was smaller. The increases in yields from delayed cutting were not as great as the decreases in yield due to delayed planting. It is evident that by early planting a very good growth may be secured by the middle of March so that the crop may be turned under for either cotton or corn.

Time of turning vetch for cotton and corn. (W. H. Appleton.—In two experiments vetch was turned for corn and cotton about March 15th, April 1st, and April 15th. Planting was usually ten days or two weeks after the date of turning. As an average of two years results the early turned vetch produced more cotton than the vetch turned late. The early turned vetch produced 328.9 pounds of lint cotton per acre. A plot receiving 300 pounds of nitrate of soda instead of vetch produced 366.2 pounds of lint cotton. The average yield of three plots that did not grow vetch or receive nitrate of soda was 141.9 pounds of lint cotton per acre.

Corn following vetch turned April 1st or April 15th, produced approximately the same yield and the yield was considerably better than that of corn following vetch turned March 15th. Apparently, vetch to be followed by corn should not be turned before April 1st, but there is no advantage in delaying turning after this time. The corn yield following vetch was as large as when the corn was fertilized with 300 pounds of nitrate of soda.

Comparison of Sulphate of Ammonia and Nitrate of Soda on Limed and Unlimed Land. (M. J. Funchess).—In 1925 an experiment was started to compare sulphate of ammonia and nitrate of soda as sources of nitrogen for cotton on limed and unlimed land. The limed plots had received two tons of limestone in 1915. Two rates of nitrogen fertilization were used, equivalent to 400 and 200 pounds of nitrate of soda. In 1925 the yield of cotton with the two sources of nitrogen were almost identical on both limed and unlimed plots. The same was true in 1926 on the limed plots. On the unlimed, however, the yield on the sulphate of ammonia plots was considerably lower than on the nitrate of soda plots, indicating some injury due to acidity resulting from the use of sulphate of ammonia. The 1926 yields from the plots on limed land were as follows: 200 pounds nitrate of soda, 571 pounds lint cotton; 150 pounds sulphate of ammonia, 509 pounds lint cotton per acre. On the unlimed land the corresponding yields were 435 pounds on the nitrate plots and 386 pounds on the sulphate plot.

Rate of Fertilizing Cotton With and Without Poisoning for Weevil Control. (M. J. Funchess and J. M. Robinson).—The Agronomy and Entomology departments have been cooperating in a study of weevil control on cotton fertilized at different rates. Table 2 gives the yields of seed cotton for 1926 and the average results for 1924 to 1926.

Table 2.—Rate of Fertilizing Cotton with and without Poison

Fertilizer per Acre	Lbs.	Yield of seed cotton per acre—Lbs. 1926 Dusted	1926 Not Dusted	Average 1924-26 Dusted	Average 1924-26 Not Dusted
Unfertilized		132	145	171.8	169.2
Acid phosphate	300				
Muriate of potash	50				
Nitrate of soda	150	688	484	620.3	525.2
Acid phosphate	600				
Muriate of potash	100				
Nitrate of soda	300	1294	912	996.4	804.9
Acid phosphate	900				
Muriate of potash	150				
Nitrate of soda	450	1680	1260	1262.5	1065.8
Acid phosphate	1200				
Muriate of potash	200				
Nitrate of soda	600	1898	1414	1385.2	1188.4

The results show profitable increases in yield with increased fertilization up to 1500 pounds per acre on both dusted and undusted cotton. An additional 500 pounds of fertilizer produced a further increase in yield but the increase was not profitable.

Dusting gave a greater increase in yield this year than any other year of the experiment. Weevil infestation was light during the early part of the growing season but reached 13 per cent on August 27. Three applications of calcium arsenate were made at five-day intervals. The infestation on the dusted plots did not go above 20 per cent but on the undusted plots it advanced from 15 per cent on August 27 to 57 per cent on September 14. The gain due to dusting varied from minus 12 pounds of seed cotton on the unfertilized plots to 204 pounds on the plot receiving 500 pounds of fertilizer and to 420 pounds on the plot receiving 1500 pounds of fertilizer per acre.

The average results for the three years of the experiment show that the increase in yield from dusting has been dependent on the rate of fertilization. Without fertilizer, dusting increased the yield 2.6 pounds per acre. With 500 pounds of fertilizer the increase was 95.1 pounds per acre; and with 1000, 1500, and 2000 pounds of fertilizer the increases from poisoning were 191.5, 196.7, and 197.8 pounds per acre, respectively. These results show rather conclusively that poisoning for weevil control is not profitable unless other conditions are favorable for the production of a good crop.

Stable Manure, Nitrate of Soda, and Vetch as Sources of Nitrogen for Corn and Cotton. (W. H. Appleton).—In the fall of 1924 an experiment was started comparing stable manure, nitrate of soda, and vetch as sources of nitrogen for cotton and corn. All plots receive essentially the same amounts of phosphorus and potash. The manure and nitrate plots receive approximately the same amount of nitrogen, 325 pounds nitrate of soda and 5 tons of stable manure annually. The vetch plot receives as much vetch as can be grown on the land in the winter.

The results of the past two years show that all three sources of nitrogen materially increased the yield and there are only small differences between the three sources. The check plots averaged 153 pounds of lint cotton per acre, the manure plot 453 pounds, the nitrate plot 418 pounds, and the vetch plot 456 pounds of lint cotton per acre. The corresponding yields of corn were 6.8 bushels on the check plots, 24.5 bushels on the manure plot, 27.9 bushels on the nitrate plot, and 27.7 bushels on the vetch plot.

Rate of Absorption of Nitrate of Soda by Cotton. (W. W. Pate).—In continuing this investigation, field experiments were made on the rate of absorption of nitrate of soda by cotton. Nitrate of soda at the rate of 300 pounds per acre was applied at planting, and 39 and 56 days after planting. At intervals thruout the growing season several representative cotton plants were harvested from each plot. These were analyzed for nitrogen and the amount of nitrate of soda absorbed was calculated. The results obtained are given in Table 3, which follows.

Table 3.—Rate of Absorption of Nitrate of Soda by Cotton when Applied at Different Stages of Growth

Time of nitrate fertilization	Nitrate of soda absorbed by cotton							
	12 days	24 days	36 days	48 days	60 days	72 days	84 days	96 days
	lbs. per A	lbs. per A	lbs. per A	lbs. per A	lbs. per A	lbs. per A	lbs. per A	lbs. per A
At planting	--	--	2	2	-2	10	80	248
39 days after planting	--	-2	74	150	178	206	--	--
56 days after planting	4	68	96	103	--	--	--	--

These data show that the time of applying the nitrate materially influenced the rate of its absorption by the plant. When applied at planting very little nitrate was absorbed by the cotton during the succeeding 60 days. Absorption, however, was rapid when the nitrate was applied 39 days after planting. Under that treatment as much of the nitrate was absorbed in 36 days as was absorbed in 84 days when applied at planting. A study of the data of Table 3 shows that the time required for the absorption of 75 pounds of nitrate varied from 83 days when applied at planting to 36 days when applied 39 days after planting, and to 27 days when applied 56 days after planting.

Cotton Spacing. (H. B. Tisdale).—A cotton spacing experiment has been conducted during the past three years. The plants have been spaced 6 inches, 12 inches, 18 inches, 24 inches, 30 inches, and 36 inches in the row and at each spacing there have been 1, 2, 3, and 4 plants per hill giving a total of 24 different spacings in the experiment. All plots have been in duplicate and have been carried with both low and high rates of fertilization.

The results for the past three years show that the best yields of cotton on both the high and low fertilized plots have been secured with a spacing of 24 inches in the row and with two plants per hill. The differences due to spacing have been very

small except where the spacing was extremely thick, as with 6 inches in the row and three or four plants per hill, and where the spacing was extremely thin as with 30 and 36 inches in the row with one plant per hill. In this experiment the number of plants varied from approximately 4,000 per acre to 100,000 per acre. Practically the same yield was obtained on almost all plots having from 10,000 to 35,000 plants per acre .

The Concentration of Phosphate and Potash Essential for Plant Growth in Culture Solutions. (F. W. Parker and W. H. Pierre).—In a continuation of the experiments on phosphorus nutrition of plants, corn was grown in 25 gallons of nutrient solution the phosphate content of which was renewed twice a day. Three corn plants were grown to each culture and the phosphate concentration in the different cultures varied from 0.05 ppm. to 0.50 ppm. PO_4. Maximum growth was obtained at a concentration of 0.30 ppm. but the growth at 0.10ppm. was very satisfactory. The total dry weight of the three plants was 49.7 grams at time of harvesting. These results show that maximum growth of corn can be obtained at very low concentrations of phosphate. As yet, however, good growth has not been secured at concentrations comparable with that obtained in the soil solution of some rather productive soils.

In some experiments in which the concentration of potassium was varied, maximum growth of corn and soybeans was secured at a concentration of 2 ppm. K. In these experiments the volume of the culture solution was only 7500 cc. It may be that maximum growth would be secured at even lower concentrations if larger volumes of culture solution were used so that the potash concentration would be maintained more nearly constant.

Methods for the Determination of the Amount of Exchangeable Hydrogen in Soils. (F. W. Parker).—A study was made of four methods of determining exchangeable hydrogen in soils. Three of these methods gave almost identical results when compared on a series of 12 soils. Exchangeable hydrogen was found to be equivalent to the difference between total exchange capacity of the soil and the content of exchangeable bases. It was also found to be equivalent to the amount of barium hydrate required to titrate a soil to pH 7.0 Finally, it may be determined by leaching 10 grams of soil with 250 cc. of normal solution of neutral barium acetate and titrating the leaching to pH 7.0 The barium replaces all the exchangeable hydrogen and the soil after being washed free of the acetate has a reaction of approximately pH 7.0. The avidity or ease of the replacement of the exchangeable hydrogen was determined by allowing equivalent amounts of exchangeable hydrogen and acetic acid to compete for an equivalent amount of the base potassium. The amount of H replaced by K was determined by titration and the percentage replaced by K indicates the avidity of exchangeable hydrogen.

A Comparison of Different Nitrogenous Fertilizers and Their Influence on Soil Reaction. (W. H. Pierre).—Greenhouse experiments have been conducted to study:

1. The buffer capacity of soils and its relation to the development of soil acidity from the use of ammonium sulfate.
2. The effect of different nitrogenous fertilizers on soil acidity.
3. Methods of correcting the acidity developed by acid-forming nitrogenous fertilizers.

It was found that soils vary greatly in their buffer capacity, some of the clay soils having approximately ten times the buffer capacity of sandy soils. The buffer capacity of soils as determined in the laboratory was found to be a good measure of the ability of soils to resist a change in the H-ion concentration and injury from the use of acid-forming nitrogenous fertilizers.

All nitrogenous fertilizers containing their nitrogen in the form of ammonia were found to develop soil acidity. The relative acidifying influence of the various fertilizers are approximately as follows: ammonium sulfate 100; Leunasalpeter 75; urea 50; ammonium nitrate 50. Nitrate of soda, calcium nitrate and Calcium Cyanamid reduced the acidity of all soils.

In order to correct the acidity formed by ammonium sulfate, it was found that for every pound used, 1.2 to 1.5 pounds of precipitated calcium carbonate were necessary. It was also found that by using basic slag as the source of phosphorus in the proportion of 22 pounds basic slag to 1 pound of ammonium sulfate the acidity developed by the latter would be neutralized. A combination of ammonium sulfate and sodium nitrate in the proportion of 30 parts of the former and 70 parts of the latter was also found to have no effect on the acidity of the soil.

ANIMAL INDUSTRY

The Effect of Minerals on Growth and Reproduction, (W. D. Salmon).—The study of diets were continued in an effort to develop a basal diet for these tests that would be too low in mineral matter for appreciable growth of rats, but would be adequate for reproduction and rearing of young when the inorganic deficiencies were made good. Two basal diets were used this year. Diet I consisted of yellow corn and peanut meal with 3 per cent of cod liver oil. Diet II consisted of yellow corn, wheat, peanut meal, and meat meal with 3 per cent of cod liver oil.

Growth was rather poor and no reproduction occurred on either diet without a mineral supplement. The addition of 1 per cent of NaCl to either diet produced marked increases in the rate of growth. This addition did not permit reproduction on Diet I but did enable the rats to litter 83 pups and raise 26 on Diet II. Diet I was improved further for both growth and reproduction by the addition of 1.5 per cent of bone meal or 1.5 per cent of bone meal and 7.5 per cent of dried yeast. These supplements also made Diet II more satisfactory for growth than the addition of NaCl alone. The addition of NaCl alone to Diet

II, however, gave as good results for reproduction and rearing of young as when further additions of bone meal or bone meal and yeast were made. In all cases where inorganic supplements were added to the diets the most satisfactory results were obtained from the diet that contained animal protein.

The chief points of interest are: The striking effect from the addition of NaCl; the rapid growth on diets containing cod liver oil but extremely low in calcium; the favorable effect of animal protein; and the irregular and rather poor results in reproduction and rearing of young on all the diets used. Much better results have been obtained previously on what were presumably even poorer diets.

Winter Feeding and Time of Marketing Steers. (J. C. Grimes).—Steers that received a ration of cottonseed meal, Johnson grass hay, and a medium allowance of blackstrap molasses for a period of 112 days made larger daily gains and carried more finish at the close of the experiment than did those receiving a ration of cottonseed meal and Johnson grass hay. The net profits per animal were approximately the same in both lots. The addition of molasses increased the cost of the ration.

Johnson grass hay alone proved to be a satisfactory ration for wintering steers. The average daily gains were increased 0.23 pound per head by adding 2.18 pounds of cottonseed meal daily. The results again indicate that it is more profitable to limit the winter ration and finish steers on grass for the June market than it is to full feed during the winter and market in the spring. The feeding of 4.73 pounds of cottonseed meal daily to steers that were being finished on grass increased the profits $5.55 per head.

Forage Crops for Fattening Hogs. (J. C. Grimes).—This is a repetition of the test conducted in 1926 to determine the value of oat and vetch pasture as a supplement to a grain ration for fattening hogs, and to determine the advisability of limiting the grain ration for fattening hogs on oat and vetch pasture.

The results secured this year are very similar to those obtained last year, both lots on pasture excelling the dry lot group in economy of gains and net profit per animal. Lot I, self-fed on pasture, made the largest daily gains, but Lot II, where the grain ration was limited, made the cheapest gains and the largest net profit. The gains this year, while satisfactory, were not as large as those obtained last year. This was probably due to the fact that the pigs were younger when started on experiment and were not as uniform in quality.

Results of the test are briefly summarized in the Table 4 below.

Table 4.—Showing summary of results when oats and vetch pasture was used as a supplement to corn and tankage, for fattening pigs.

(Feb. 18 to May 12, 1927—84 days.)

RATIONS:	Lot I Corn, Tankage, Minerals, Self Fed—Dry Lot	Lot II Corn, Tankage, Minerals, on ¾ Acre Oats & Vetch Pasture. Self Fed.	Lot III Corn, Tankage, Minerals. Hand Fed, 3% Live Weight on Pasture
Number of hogs per lot:	8	9	8
Average initial wt. per lot:	441	506	450
Average initial wt. per hog:	55.0	55.5	56.2
Average final wt. per lot:	1125	1615	1105
Average final wt. per hog:	140.6	179.4	138.1
Total gain per lot:	684	1109	655
Total gain per hog:	85.5	123.2	81.8
Average daily gain per hog:	1.02	1.4	.97
FEED CONSUMED PER LOT—			
Corn:	2412.82	3562.14	1739.85
Tankage:	163.81	165.48	140.70
Total feed:	2576.63	3727.62	1880.55
AVERAGE DAILY FEED PER HOG—			
Corn:	3.62	4.63	2.59
Tankage:	.24	.22	.21
Total daily feed:	3.86	4.85	2.80
Total feed per pound gain:	3.74	3.36	2.87
*Feed cost per 100 lbs. gain:	$ 8.28	$ 7.24	$ 6.22
Av. cost per hog when experiment started:	$ 4.57	$ 4.57	$ 4.57
Feed cost per hog during fattening period:	$ 7.07	$ 9.02	$ 5.09
Total cost per hog at close of experiment:	$11.64	$13.59	$ 9.66
**Selling price per hog:	$12.77	$15.69	$12.08
Profit per hog:	$ 1.13	$ 2.10	$ 2.42

*Price of feeds: Corn $1.20 bu.; tankage $60.00 per ton.

**All hogs sold for $8.75 per cwt.

NOTE: Pasture not considered in calculating feed cost.

Minerals in the Dairy Ration. (W. H. Eaton).—The College dairy herd was divided into three groups, all cows being given similar treatment as to feeding and general care. The cows in each group are fed as follows:

Group I. No minerals — check,
Group II. Four ounces steam bone meal daily,
Group III. Four ounces marble dust daily.

The calves dropped in each group were weighed and measured at birth and in 28-day periods thereafter. A study of the birth record of 27 calves shows that those born of non-mineral-fed dams were heavier at birth and were slightly larger in five measurements than the calves born in the mineral-fed groups.

10-Months Lactation Record of Cows

No. Cows:	Test:	Average Pounds Milk:
7	No Mineral	4623.5
7	Bone Meal	5631.3
6	Marble Dust	4818.0

The milk records show the highest average production in the bone-meal-fed group, the lowest in the group receiving no mineral with the marble dust group being intermediate. These records are by no means conclusive as the cows in the three groups were not of uniform age.

Effect of Color of Soybeans on Gains of Hogs and Quality of Carcass. (W. D. Salmon).—In this experiment Mammoth Yellow and Tar Heel Black soybeans were compared as supplements to corn for fattening hogs in the dry lot. Two lots of 12 hogs each were used. The corn, soybeans, and mineral mixture were self-fed, free choice.

During the first 28 days the hogs on black beans made an average daily gain of 2.0 pounds and required 310.8 pounds of feed for 100 pounds of gain. Those on yellow beans averaged only 1.6 pounds per day and required 390.3 pounds of feed for 100 pounds of gain. However, during the second 28 day period some of the hogs in the black bean lot became stiff and lame with a tendency to go down in the hind quarters. These symptoms did not appear among the hogs that were receiving yellow beans.

As a result of the condition mentioned there was a complete reversal of the standing of the two lots at the end of the second period. In this period the average gain on black beans was 0.76 pounds with 692.4 pounds of feed for 100 pounds of gain, while the average daily gain on yellow beans was 1.82 pounds with 432.8 pounds of feed for 100 pounds of gain. For the entire 56-day test the average daily gain on black beans was 1.38 pounds and the feed required for 100 pounds of gain was 416.3 pounds. The average daily gain on yellow beans was 1.71 pounds and the feed for 100 pounds gain was 412.8 pounds.

The carcasses were somewhat softer in the black bean lot than in the yellow bean lot. This was probably due to the lighter weights of the hogs and the somewhat larger proportion of beans to corn consumed by the hogs in the black bean lot.

Effect of a Starvation Period on the Firmness of the Carcass of Hogs. (W. D. Salmon).—Twelve hogs weighing 100 to 137 pounds were fed peanuts, supplemented with tankage, cod liver oil, and mineral matter until they reached a weight of 200 pounds. They were then starved for losses varying from 20 to 45 pounds. After the starvation period they were fed corn, shorts, and tankage until they weighed 225 pounds.

The hogs were then slaughtered and the iodine numbers determined on the back fat from each hog. The iodine numbers varied from 74.50 to 89.41 and did not indicate that the starvation period had any practical effect in increasing the firmness of the fat.

Factors Affecting the Vitamin B Content of Plant Products. (W. D. Salmon).—It has been found in this investigtaion that vitamin B is a complex, consisting of at least two active sub-

stances. One of these, which we are tentatively designating as factor B-P, prevents the occurence of *beriberi* in rats and pigeons. It is not a specific promoter of growth but must be in the diet before growth can occur. The other substance is without antineuritic, or *beriberi*-preventing action, but is a marked growth stimulant when combined with the B-P factor. This growth-promoting substance is identical or associated with factor B-P which prevents the occurrence of pellagra-like symtoms in rats.

The seeds of velvet beans and soybeans are relatively richer in the B-P factor than the dried leaves of velvet beans and of rape. However, they are not as rich as the leaves in the growth-promoting fraction.

The B-P factor is more readily absorbed by fullers' earth from an acidulated aqueous solution than is the growth-promoting substance. This offers a method for making a partial separation of the two factors. The growth-promoting substance is also absorbed by the fullers' earth and if large amounts of fullers' earth are used both factors are removed and no separation is effected.

Vegetable Protein Studies. (John E. Ivey).—Experimental data show conclusively that protein in available form is essential to egg production. There is produced a limited supply of animal protein. Protein in this form is, therefore, expensive and in certain parts of this State very difficult to obtain. The use of protein of vegetable origin in laying mashes would be very desirable from an economic view-point provided normal vitality and production can be maintained on such rations. This is particularly true in Alabama where protein supplements of vegetable origin are produced in abundance.

Eight groups of 35 S. C. White Leghorns each were used to determine the advisability of using vegetable proteins in the laying mash. Each group was housed in a pen 10 x 16 feet, with a runway 20 x 100 feet. All birds received whole yellow corn as their source of grain, receiving 7½ pounds of grain daily per hundred birds. Each group of birds received a basal mixture of ground corn one part, ground oats one part, and standard wheat middlings one part. Pens 2 and 7 had enough cottonseed meal added to the basal ration to make a 13 per cent digestible protein content. Pens 3 and 8 had enough peanut meal added to the basal ration to make a 13 per cent digestible protein content. Pens 4 and 9 had enough soybean meal added to the basal ration to make a 13 per cent digestible protein content. Pen 6, control lot, had enough meat scrap added to the basal ration to make a 13 per cent digestible protein content.

Four pounds of the following mineral mixture was added to each 100 pounds of mash:

Steambone meal 50 pounds, marble dust 25 pounds, and common salt 25 pounds.

In addition to this, oyster shell and calcium carbonate grit were accessible to the birds at all times. Each pen received the same amount of green feed per bird throughout the year.

Every precaution was exercised to have all the birds in each pen as near alike as possible. However, upon studying the individual records sufficient evidence is presented to show the necessity of starting feeding experiments with birds having been trap nested. Tables 5 and 6 are a record to date.

Table 5.—Egg Production, Mortality, and Profit Per Hen as Affected by Vegetable Proteins

(November 1, 1925—October 31, 1926)

Group	No. Birds	No. Eggs Per Hen	% Mortality	Profit Per Hen
Cottonseed Meal	70	137.00	8.75	3.33
Peanut Meal	70	117.75	14.28	2.66
Soybean Meal	70	128.60	21.43	3.14
Control (Meato)	35	113.10	14.43	2.39

Table 6.—Per cent Infertility, Per cent Embryonic Mortality, and Per cent Hatchability as Affected by the Various Vegetable Proteins

Group	No .Eggs* Set	% Infertile**	% Embryos Dead 18th Day	% Embryos Dead 21st Day	% Eggs Hatching
Cottonseed Meal	2432	11.18	9	39.8	39.60
Peanut Meal	1814	8.04	3.63	20.89	67.30
Soybean Meal	2214	19.19	8.49	32.83	39.47
Control (Meato)	1085	9.77	4.8	23.68	61.70

The birds receiving cottonseed meal produced more eggs, had less mortality, and showed a higher profit per hen than any other group. The birds receiving soybean meal ranked second in egg production, had the highest per cent mortality, and ranked second in profit per hen. The birds receiving peanut meal ranked third in production, second in mortality, and third in profit per hen.

Apparently cottonseed meal and soybean meal affected the fertility of the eggs in a small degree. Special attention is called to the high rate of embryonic mortality between the 18th and 21st day in the cottonseed meal and soybean meal groups. Eggs from the birds receiving cottonseed meal and soybean meal had a low per cent hatchability.

* All eggs produced from February 1st to May 1st, inclusive were incubated.

** All male birds were changed each week.

Force Molt Studies. (John E. Ivey).—The price of eggs varies inversely with the production. When production is highest prices are lowest. Spring is normally the season of high production. Fall is the season of low production because it is the normal time of molting. It would, therefore, be advisable from an economic viewpoint to cause the molt in the spring or early summer in order that maximum production may be obtained in the fall and winter. The difficulty lies in the fact that the birds have a tendency to molt again at the normal time in the fall;

and, as a result, the annual egg production is decreased. The time for forcing the molt and the system of feeding to prevent second molt is being studied.

Three groups of 35 S. C. White Leghorns each were used to determine the advisability of forcing an early molt. Each group of birds was housed in a pen 10 x 16 feet, having a runway 20 x 100 feet. All birds received whole yellow corn as their source of grain, receiving 7½ pounds of grain daily per hundred birds. Each group of birds received a basal mixture of ground corn one part, ground oats one part, and standard wheat middlings one part, with enough animal protein added to this to make a 20 per cent digestible protein content. Four pounds of the following mineral mixture were added to each 100 pounds of mash: Steambone meal 50 pounds, marble dust 25 pounds, and common salt 25 pounds.

Pens 1 and 10 were force molted during the month of June by being denied laying mash 14 days. At the expiration of this time they received a dose of Epsom salts and were immediately placed on the regular mash mixture, causing them to shed their feathers.

Pen 5 was the control to pens 1 and 10 and was not force molted.

Table 7 (part 1).—Egg Production, Mortality, and Profit Per Hen as Affected by Force Molt

Group	No. Birds	No. Eggs Per Hen	% Mortality	Profit Per Hen
Force Molt	70	117.9	18.57	$2.76
Control	35	110.8	17.14	$2.34

Table 7 (part 2).

Group	No .Eggs* Set	% In-fertile**	% Embryos Dead 18th Day	% Embryos Dead 21st Day	% Eggs Hatching
Force Molt	2180	11.23	6.74	21.10	60.90
Control	1021	12.90	8	16.55	62.50

Birds that were forced to molt in June produced 7.1 eggs per hen more than those birds that molted at the normal time. The forced molt birds showed a profit of 42 cents per bird over the control birds. Forced molting apparently had no effect on the fertility and hatchability of eggs.

Before this practice is recommended for general use a great deal more work should be done in this connection, using a larger number of birds for experimental basis.

* All eggs produced from February 1st to May 1st, inclusive, were incubated.
** All male birds were changed each week.

BOTANY

Physiology of Sweet Potatoes. (Wright A. Gardner).—Changes in the percentage of moisture and carbohydrates were found to be closely associated with changes in soil moisture as influenced by weather conditions. The initial percentage of

moisture of the 1926 crop was nearly 8 per cent higher than that of the 1925 crop. The average gross shrinkage due to curing was nearly 15 per cent in 1926 while in 1925 it was about 10 per cent. Since the shrinkage of controls in the air tight cans during the curing process amounted to 1.3 per cent we may credit the curing process with causing a shrinkage of 13.7 per cent.

Certain representative lots showed an additional shrinkage of more than 7 per cent, or a total of nearly 23 per cent. Leaving sweet potatoes undisturbed in the ground until frosts tended to increase their percentage of moisture and to decrease the percentage of starch. Due to a difference of 7 per cent in the moisture content, the metabolism of "cured, not ventilated" sweet potatoes of 1926 and 1925 took place at different levels, even though its general course was similar.

The Decomposition of Chlorophyll in the Rinds of Satsuma Oranges. (Wright A. Gardner).—Acetylene 1 to air 4000 and ethylene 1 to air 4000 are far superior to motor exhaust for coloring oranges when the temperature is kept at 25°C., with high moisture. For the chlorophyll-decomposing enzyme of satsuma orange rinds the cardinal temperatures were found to be: Minimum, below 13°C., optimum, about 45°C., maximum, about 75°C., and the thermal death point, 80°C. Oxygen treatment promotes the destruction of chlorophyll in the rinds of satsuma oranges, while the above mentioned hydrocarbons in high and medium concentrations inhibit decomposition. In high dilutions the hydrocarbons may stimulate the action of the chlorophyll-decomposing enzyme. The juice of green untreated orange rinds frequently lack the enzyme. This enzyme seems to require a substratum with a slightly acid reaction since it does not function in solutions that are slightly alkaline.

Disease Resistance in Sweet Potatoes. (Walter L. Blain).—During the year emphasis was placed on the resistance to black rot of numerous varieties and selections of sweet potatoes. Inoculation of slips—sixty different varieties and selections—growing in clay pots in the greenhouse showed that Bigwig White No. 23 was less susceptible to the black rot organism than any other variety. While Nancy Hall, Porto Rico, Triumph, and Big Stem Jersey (which are the varieties of sweet potatoes most commonly grown in the South) did show more or less infection in each of the above tests, other results indicate that the Gold Coin, Southern Queen, Nancy Hall, and Porto Rico varieties of sweet potatoes are very susceptible to black rot; that Dooley, Bunch Yam, and Yellow Yam varieties are somewhat susceptible; while Big Stem Jersey and Triumph varieties are less susceptible.

Pecan Scab and its Control by Means of Sprays. (Walter L. Blain).—The scab organism was isolated from Alley, Pabst and Schley pecans and grown in pure culture. Lima bean agar was found to be the best substratum. A temperature of 23°C., was found to be best for the growth of the organism in pure cul-

ture. Results demonstarte that pecan scab can be controlled rather easily by the use of a 3-3-50 Bordeaux mixture in a machine of adequate capacity and power to throw a fine spray over both sides of leaves, twigs, and branches of all parts of the tree. The first application should be made as soon as pollination occurs (about May 15), followed by two more at three-week intervals. If scab persists the fourth application should be made one month after the third.

CHEMISTRY (Agricultural)

Velvet Bean Rations for Brood Sows. (Emerson R. Miller and J. C. Grimes).—A Duroc Jersey sow received velvet beans in the pod (with a mineral mixture available) for the first 48 days of the gestation period and raw velvet bean seed (ground) supplemented by mineral matter, cod liver oil, and 10 per cent of casein for the remainder of the period. The latter ration was the same as given this sow for the ninth litter except that the beans were not cooked for the tenth litter.

On the ration containing the raw beans the sow farrowed 12 pigs of which 4 were probably dead at birth. The average weight of dead pigs was 2.425 pounds, of those living, 1.878 pounds.

Though undersized, the pigs apparently ranked well in vitality and the sow had a good supply of milk. One week after farrowing the sow passed a dead pig badly decomposed and largely absorbed. Beginning at this time the sow was "off feed" for three days and would not allow the pigs to suck as often as usual.

During the first week the pigs made unusual gains. They were sleek and plump and very active, but after the eighth day they began to lose their fine appearance and, for the second week, made much smaller gains than are usually made. The sow's milk supply decreased very decidedly. The pigs were given skimmilk and as much normal ration as they would eat, but they made slow gains.

Stability of the Antineuritic Vitamin Towards Heat. (Emerson R. Miller and E. F. Williams).—A commercial chicken feed, both whole and powdered, was heated to 130°C. for 5 hours, also to the same temperature for 10 hours. The results of feeding this ration to pigeons are summarized in Table 8.

Table 8.—A Summary of the Results of Feeding Commercial Chicken Feed Heated to a Temperature of 130°C. for Five Hours to Determine the Stability of the Antineuritic Vitamin toward Heat

No. of pigeon	Ration	Amt. feed daily	Loss in wt.	No. of days fed	Cause of death
7	50% heated rice, 50% heated chicken feed powdered	15.9 gms. for first 21 days 19.9 gms. ave. for period	8.8% 21.3%	86	Apparently of suffocation
8	Same as for No. 7	17.9 gms. for first 35 days 18.5 gms. ave. for full period	14.3% 14.8%	90	Paralysis of crop
9	75% heated rice, 25% heated chicken feed powdered.	14.8 gms.	39.3%	Died on 40th day	Symptoms of polyneuritis
10	Same as for No. 9	16 gms.	18.6%	Died on 33rd day	Choked while being fed
11	75% sterilized rice, 25% pulverized chicken feed not heated	17.3 gms. for first 35 days Hand fed from 36th day. 19.2 gms. for entire period	22.5% lost 26% in 50 days.	Died on 50th day	Paralysis of crop
12	Same as for No. 11	17.9 gms. for first 35 days. Hand fed after 35th day.	lost 21.4% in first 35 days.	Died on 41st day.	Apparently same as for No. 11

On the whole pigeons on the heated ration did about as well as those on unheated.

In further experiments two pigeons were fed about 90 days on a ration of polished rice and heated chicken feed 1:1. Both died but the symptoms were not those usually characteristic of polyneuritis.

Two pigeons were fed a ration consisting of 75 per cent polished rice and 25 per cent of chicken feed previously heated to 130°C. for 10 hours. Both died in about 4 weeks, one showing symptoms of polyneuritis.

Two pigeons were fed a ration consisting of 75 per cent polished rice previously heated to 130°C. for 5 hours and 25 per cent of chicken feed not heated. One died on the 50th day and the other on the 41st day, neither, apparently, from polyneuritis.

Since the feeding of powdered material was attended with much difficulty it is quite probable that most of these pigeons died from improper feeding as was shown by post mortems made by Dr. N. G. Covington.

ECONOMICS (Agricultural)

A Study of Local Cotton Marketing. (J. D. Pope).—The object of the local cotton marketing study was to determine the relation of the quality of cotton marketed to the price which the farmer received. The data secured also indicate the percentage of different staple lengths and grades marketed in Alabama.

From August to December inclusive, 1926, samples of 5431 bales of cotton were collected at 16 towns, representing various parts of Alabama. The cooperators were asked to supply samples according to the "run of the crop" in order that the results might be typical of the entire Alabama crop. The government classification was received for 5407 bales and is shown in Table 9.

Table 9.—Government Classification of 5407 Bales, Alabama Crop 1926

Grade	Color									
	White		Spotted		Yel. Tinged		Yel. Stained		Gray	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
St. Good Mid.	31	0.6								
Good Middling	1042	19.3	204	3.8	14	0.3	1	0.0	1	0.0
Strict Mid.	1636	30.2	405	7.5	30	0.6	1	0.0	3	0.1
Middling	1076	19.9	210	3.9	13	0.2				
St. Low Mid.	522	9.7	57	1.0	8	0.1				
Low Middling	117	2.2	4	0.1						
St. Good Ord.	19	0.3								
Good Ord.	7	0.1								
Total	4450	82.3	880	16.3	65	1.2	2	0.0	4	0.1

Below grade 6, 0.1 per cent.

Fifty-four per cent of these bales were above middling in value, 20 per cent were middling, and 26 per cent were below middling. Ninety-eight per cent of this cotton was tenderable on future contracts.

The data collected indicated that the average grade of the cotton marketed became lower each month from September to December.

The government classification of 5398 bales according to length of staple indicated that 92.6 per cent of the total were 7/8 inch and 6.2 per cent were 15/16 inch. Seven-tenths of one per cent were below 7/8 inch and one-half of one per cent was of inch length and above. Only 3 bales out of 5398 were 3/4 inch and 32 bales were 13/16 inch. Nine bales were 1 inch, 6 bales 1 1/32 inch, 11 bales 1 1/16 inch and only one bale 1 1/8 inches. These figures show that there was no widespread problem in 1926 of marketing either extra short staple cotton, or cotton of inch-length and above, since those lengths constituted only about one per cent of the total crop.

Most of the cotton of inch staple and above came from the Tennessee Valley and from West Central Alabama. The one bale of 1 1/8 inch came from Chilton county.

A feature of the study was a comparison of government grades with

buyers' grades where the latter were available. The table below shows the grade classification of 305 bales at a certain Alabama town by the government and by the local buyer.

Table 10.—Government and Local Buyers' Grades, 305 Bales, One Alabama Town, 1926

Grade	Average points on or off Middling. Montgomery		No. of bales in each Grade	
			Government	Local buyer
WHITE				
Good Middling	On	61	16	--
Strict Middling	On	41	59	17
Middling	Basis		52	72
St. Low Middling	Off	110	50	69
Low Middling	Off	285	33	92
St. Good Ord.	Off	449	6	52
Good Ordinary	Off	571	1	3
SPOTTED				
Good Middling	On	9	14	--
Strict Middling	Off	16	26	--
Middling	Off	100	30	--
St.. Low Middling	Off	250	16	--
YELLOW TINGED				
Strict Middling	Off	100	1	--
St. Low Middling	Off	100	1	--
Total			305	305

On the basis of the average differences quoted in the Montgomery spot market for the different grades these bales would have been worth (according to government grades) 89 points off middling. They would have been worth according to the local grading, 250 points off middling. This is an indicated value of 1.6 cents per pound or $8.00 per bale in favor of government grading.

In a number of instances wide variations occurred in the prices paid for cotton of identical grade (according to government classification, on the same day. For instance on October 6, the prices paid for 25 bales of middling cotton by six buyers in as many towns in Alabama ranged from 8¼ cents to 13 cents per pound. a spread of 4¾ cents per pound or $23.75 per bale. On the same day New York futures showed a spread from low to high of 31 points. It appears that some explanation other than fluctuations in central markets must be found for these wide variations in prices paid to farmers.

ENGINEERING (Agricultural)

A Study of the Fundamental Factors Influencing the Traction of Wheel Tractors. (J. W. Randolph and M. L. Nichols).—Correlations were established between laboratory data with a static wheel, method and results previously reported and field results obtained with actual tractors, which can be expressed as follows:

$$O2 = O1 \frac{\sqrt{L2} + D2 + W2}{\sqrt{L1} + D1 + W2}$$

O1 output of static wheel and O2 output or drawbar pull of tractor. L lug depth, D diameter of wheel, and W weight per inch of rim width, one and two respectively.

By means of the formula the power of a given tractor can be determined by means of data from another so long as the motor is not a limiting factor.

The plaster cast studies of force distribution were continued. A comparatively close check was obtained between calculated and actual distortion. Weight on wheel and depth of lug is a function of the direction and amount of soil distortion. Shear in the soil takes place perpendicular to the resultant of lug and rim displacement. By taking advantage of the soils arch action the lines of shear can be given greater distortion through the soil, resulting in greater drawbar pull of the tractor.

Soil Dynamics. (M. L. Nichols).—A study of the physical properties of the soil as they affect implement design was continued. Particular attention was given to adhesion; and it was found that the adhesive properties of the metal could be varied by various heat treatments, rapid cooling in mercury giving the lowest adhesion.

Sterilization of Dairy Utensils. (M. L. Nichols).—An electric sterilizer was devised, consisting of a float which could be attached to an ordinary Bayonet heater which kept the heating coil immersed, giving a minimum of water to be heated and a maximum amount of steam.

Solar Water Heating. (A. Carnes).—A device that used the sun's energy for heating water for household and dairy purposes was built and tested at the College dairy. This consists of three 30″ x 60″ sections built of corrugated roofing riveted to flat roofing and so arranged that the water would pass between the two middle surfaces. This heater was covered with glass. The heated water was stored in a gravity tank of 500-gallon capacity. The water temperature obtained in the months of August, September, and October ranged from 90°F. to 150°F. in sufficient quantities for the use of a dairy of thirty cows.

Farm Machinery. (M. L .Nichols).—Local experiment work was continued in South Alabama; and the requirements of a cultivator for cotton, corn and peanuts were determined. The requirements of a riding cultivator, as found by this work, are that the pipe gang is best adapted to the plants grown on a bed or in the water furrows as it permits adjustments for "dirting" in the same manner as the Georgia Stock. The further requirements for the riding cultivator are that it should have a fairly high wheel, and, preferably, pivot axle control. It was found that the walking cultivators used in this section have the requir-

ed adjustments which were lacking in many of the riding cultivators.

Labor studies were continued and it was found that next to the cultivator the combination planter and fertilizer distributor was the most valuable tool. The requirements of agriculture were best met by the Lister type planter developed for southwestern conditions.

ENTOMOLOGY

Belted Bean Beetle, Diabrotica balteata. (J. M. Robinson).—In studying the life history of this insect it was found that the average incubation period was 3.8 days. The larval development period was 15 days, and the average pre-pupal period 3 days. Only one adult emerged which required 8 days for pupation. The time required for the complete life history, from egg to adult, was 31 days. Total number of larvae used, 39. Total numebr of adults emerged, 1.

Boll Weevil Control With Calcium Arsenate. (J. M. Robinson).—The work on boll weevil control was continued in 1926 on three types of soil—namely, Norfolk Sandy Loam, Cecil Red Clay, and Houston Clay. The Norfolk sandy loam plots were on the Agricultural Experiment Station farm, and the results are reported on page 7. The Cecil red clay plots were in Lee County and the Houston clay plots were in Montgomery County.

On the heavy red clay two series of plots were used, one on old ground and the other on newly cleared ground. The boll weevil infestation did not approach 10 per cent until July 26. The average infestation for the dusted plots during the growing season was 5.6 per cent. For the undusted plots the average infestation was 11 per cent. Five applications of dust were made, one was washed off within twenty-four hours and the last application, according to the infestation record, was unnecessary. On the old ground there was a gain of 90 pounds of seed cotton per acre, and on the newly cleared ground a gain of 150 pounds of seed cotton per acre as a result of dusting. These gains were not sufficient to make a profit from dusting.

On the "black belt" soil the boll weevil infestation was 10 per cent on June 25. Two series of three applications of calcium arsenate were needed beginning June 25, and on July 16. Three dustings were washed off by rain within twenty-four hours after application. The infestation was heavy throughout the growing season on the undusted plot. Nine applications of dust were made throughout the season. There was a gain of 300 pounds of seed cotton per acre on the dusted plots.

Boll Weevil Hibernation. (J. M. Robinson).—A total of 3,804 boll weevils were placed in the hibernation cages in the fall of 1926. The total number of emerged boll weevils in the spring of 1927 was 13 or .003 per cent.

Cotton Flea Hopper. (J. M. Robinson-F. S. Arant).—Cotton flea hoppers were present in large numbers during July and August on both the Experiment Station and Whatley farms near Opelika. Considerable damage was done to cotton early in the season. Not more than half a bottom crop was set at Auburn and practically no bottom crop at Whatley's. Good top crops were set at both places, due partially to a let up in abundance of hoppers. The boll weevil was not a factor in the cotton hopper plots, practically none being present. Applications of sulphur (6 to 10 pounds per acre) at five-day intervals reduced the infestation and materially increased the yield. Sulphur and calcium arsenate (equal parts, 10 to 12 pounds per acre) indicated that it might be valuable in combatting weevils and hoppers combined. Nicotine dust and calcium arsenate (equal parts) showed substantial gains. However, the expensiveness of the dust practically neutralized the benefit of its good qualities. There was a loss when nicotine dust F2 mixture was used alone.

The data in Table 11 show the average number of adult and nymph cotton flea hoppers per sweeping and seed cotton per acre.

(Table, next page).

Oriental Fruit Moth. Laspeyresia molesta Busck. (Henry G. Good).—During a period of four months, 129 adults were found in bait buckets containing white and brown sugar, molasses, cane and corn syrup. There were four distinct generations per year, occuring in early May, middle June, late July, and early September. Culled fruit (25 per cent of crop) had an infestation of 3.7 per cent which showed very slight attack to the fruit.

Southern Corn Root Worm. (F. S. Arant).—Forty-nine adults were caught and caged from June 22, 1926, to January 24, 1927. Fifty-one eggs were secured August 1. Four adults emerged by September 1. The average length of time from egg to adult was 31.8 days. The greatest rate of damage to corn occurred when the larvae were from eight to fifteen days old.

Apparently there is no definite period of complete hibernation. Adults were active on warm days and inactive on cold days throughout the winter. Calcium arsenate is very effective in killing adults.

Table 11.—Average Number of Cotton Flea Hoppers Per Sweeping* and Seed Cotton Picking Record

(The Alabama Agricultural Experiment Station and T. J. Whatley Plots. 1926.)

Plots	Nicotine F_2		Nicotine F_2 Calcium Arsenate		Sulphur		Sulphur Calcium Arsenate		Undusted	
	Adults	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults	Nymphs
Auburn	11.2	5.9	9.8	6.1	6.7	4.5	7.8	5.2	11.7	8.4
Whatley	5.4	2.9	4.7	2.5	5.1	1.6	5.9	2.5	6.7	3.7
	Seed Cotton Per Acre									
Auburn	623.3		835.4		941.7		812.5		594.0	
Whatley	1290.0		1620.0		1660.0		1600.0		1340.0	
Gain	0.0		260.5		334.0		240.0			
Loss	21.0		000.0		000.0		000.0			

*A sweeping consisted of ten strokes with an insect net over the cotton foliage.

FARM MANAGEMENT

Cost of Producing Oats and Certain Other Crops. (J. F. Duggar).—Records made in the central and eastern counties showed extreme differences in total cost of production. The crop year 1926 was favorable in this region to yields of oats somewhat above the average. The cost of production on a few farms was below 25 cents per bushel, when man and mule labor were both rated at $1.00 per day, and when charges were made to cover the interest on land and the interest and depreciation on machinery. On a few farms the cost of production rose to a figure above 70 cents per bushel, or distinctly above the average selling price of oats.

Apparently the most important factor in reducing the cost of oats was a relatively high yield per acre. The group of farms producing oats at the lowest cost averaged a little above 40 bushels an acre in comparison with an average slightly above 27 bushels for the group in which production costs per bushel were highest.

Hindrances to the Growth of Alfalfa. (J. F. Duggar).—In 1926, as in 1925, three forms of phosphate applied as a top-dressing in the spring on a well established alfalfa sod, afforded increases in the current crop even on a good grade of lime or prairie upland. This increase in hay obtained in the cuttings made subsequent to the date of application (May 14) was 840 pounds per acre where 300 pounds per acre of acid phosphate was applied; somewhat similar increases were afforded by comparable amounts of basic slag and rock phosphate. Apparently in this field the deficiency of available phosphorus was not suf-

ficient alone to explain the rather indifferent yield of alfalfa hay. Certain weedy grasses made an especially strong growth, reducing the yield and grade of hay from the alfalfa plants.

In this experiment—and in most other alfalfa fields studied in the Central Prairie Region—there was found in 1926 an unusually large amount of depredation by leaf-eating caterpillars. These were identified by the Department of Entomology of this Station as the larvae of both the yellow roadside butterfly and the fall army (or grass) worm. Fungous diseases were also in evidence.

The Response in Nodule Formation and Growth of Winter Legumes to Varying Weather Conditions. (J. F. Duggar).—Divergent weather conditions were secured by planting respectively near the first of October, November, December, and March, seeds of many species of vetches, clovers, bur clovers, sweet clovers, and other legumes, with well-known grains and grasses as checks.

Rate of Formation of Root Nodules.—Most of the commonly-grown vetches and winter peas developed one nodule or more per plant within 6 to 9 days after plantings made near the first of October. When planting was done the first week in November the time required for most species was 11 to 21 days. When planting was made as late as the first few days of December the time between the coming up of the plants and general tubercle formation was lengthened, becoming for most species 22 to 31 days. When planted the last week in February most kinds of vetch developed root tubercles almost as rapidly as when planted in October.

Growth as Influenced by Date of Planting and Resultant Weather Conditions.—With practically every species (planted in rows three feet apart) the total growth or yield of dry matter in the tops decreased as the time of planting was postponed beyond the first days of October. Likewise dried samples from each planting made at such dates as to afford in the respective time intervals an equal amount of heat (or sum of daily mean temperatures) indicated that the plants from earlier plantings were notably earlier in reaching a stage or size suitable for grazing, plowing under, or haying.

Length of Life Period as Influenced by Time of Planting and by Consequent Weather Condition.—As the date of planting became later the number of days from the emergence of the seedlings to the beginning of blooming was successively shortened for practically all species of winter-growing plants under test. Yet the plants coming up earliest were almost invariably the first to bloom, though often by only a few days.

Promptness of Tubercle Formation from Planting Hulled Versus Pod-Covered Seeds.—When both clean and burry, or pod-covered, seeds were inoculated by dipping them in water containing the nitrogen-fixing organisms there was quicker and more intensive nodule formation on the young plants that sprang from unhulled, or pod-covered, seeds of crimson clover and three kinds of bur clover than from clean or hulled seeds of the corresponding species. On the other hand, where both kinds of seeds were planted without dipping—becoming inoculated from bacteria already in the soil—the seedlings from clean or threshed seeds were quite as prompt in developing root tubercles as those from burs or unthreshed seeds.

HORTICULTURE

Apples. (C. L. Isbell).—A study was made of the influence of certain fertilizers and cultural treatments on the growth of apple trees. The trees were set in 1919 and the fertilizer and

cultural treatments were started in 1925. Increase in trunk circumference in 1926 was taken as an indication of growth. The fertilizer and cultural treatments included nitrate of soda alone and in combination with acid phosphate and muriate of potash; nitrate of soda and muriate of potash; nitrate of soda and acid phosphate; nitrate of soda, acid phosphate, muriate of potash and summer and winter legumes for green manure; and basic slag and vetch. The treatments above were followed by clean cultivation. Two other treatments were used—nitrate of soda and sod mulch and hardwood leaves and pine straw. The latter treatment produced the greatest growth.

Pecan—Variety Test. (C. L. Isbell).—It was reported in the thirty-fifth annual report that the Delmas variety was leading in tree growth and yield, and that it was the only variety showing scab infection. From that time until the spring of 1927 no further effort was made to control scab. This variety continued to lead in tree growth and set of nuts, but scab infection was so severe in 1926 that this variety did not mature any nuts. Pabst and Schley nuts showed some scab in 1926, and there were a few scab spots on Success. Centennial, Frotscher, Columbian, Russell, Stuart, VanDeman and an unknown variety—probably Brooks —have not become infected.

Studies in Fruit Bud Formation of Pecan and the Growing Habits Associated with it. (C. L. Isbell).—Experiments to determine the influence of ringing and pruning (by heading back) on fruit-bud formation were carried out between March 17, and 25, 1927. Varieties treated were Delmas, Pabst, Stuart and Success. Shoots treated were well developed and of the previous year's growth. At the time treatment was given, well-developed buds near the terminal part of shoots were starting growth. The shoots were ringed or pruned below buds which were starting growth, which means that the treatment was above the buds on the base of the shoots which normally remain inactive or produce only catkins and weak vegetative shoots that drop with the catkins, and below buds which would have normally produced most of the vegetative growth and catkin flowers and all of the pistillate flowers. Treatments were as follows:

A ring of bark three-eights of an inch wide was carefully removed and the ringed portion of the shoot wrapped immediately with waxed budding cloth. The cloth was wide enough to rest on the bark on either side of the ring, thereby shading the ringed portion and yet not interfering with formation of callus or healing of ringed part.

A ring of bark three-eights of an inch wide was carefully removed and the ringed part wrapped with a strip of waxed cloth narrow enough to prevent healing of the ring.

A ring of bark three-eights of an inch wide was carefully removed and the ringed part of shoot was not wrapped. A copper wire was twisted around the shoot tight enough to cut through the bark.

Shoots were pruned by heading back at a point similar to where ring of bark was removed, or wire was tightened around shoots.

The following results were obtained from these treatments:

On shoots ringed by removal of bark, the buds that started growth above the point of treatment quit growing almost immediately, and the entire

shoot above the point of treatment died within a short time. Buds below point of treatment came into growth rapidly and behaved as normal shoots, even to the production of nuts. Callus did not form with any of the ringed shoots. This is very different from the behavior of shoots ringed during the last ten days of July, 1924.

The shoot did not die above the girdle where copper wire was not wrapped tight enough to entirely cut through the bark to the wood. In some cases it fruited, and in others it did not. The response was apparently governed by the tightness of the wire. With some shoots response occurred both above and below the girdle.

Buds remaining on pruned shoots came into growth and behaved as normal shoots, even to the production of nuts.

Responses are illustrated in figures 1, 2, and 3.

Figure 1.—Response of Shoots Ringed Between March 17 and 25, 1927. Bark Was Removed at Point Indicated by Arrow, Except in Case of No. 3, Reading from Left to Right. With it the Bark Was Cut but not Removed.

Figure 2.—Response of Shoots Girdled by a Copper Wire Between March 17 and 25, 1927.

Figure 3.—Response of Shoots Pruned Between March 17 and 27, 1927.

Blueberries. (C. L. Isbell).—During the winter of 1924-1925 two plantings of blueberries were made. One planting was made on more or less elevated, dry, poor, sour, sandy soil, and another on similar but low, moist soil. Each planting carried blueberry plants from Whitesbog, New Jersey, and the wild-high-bush type found growing in the swamps of South Alabama and North Florida. The behavior of the plants in these plots to date warrant the following statements:

Blueberry plants from New Jersey, with the exception of Harding variety, cannot withstand very dry summers under clean cultivation; southern blueberry plants will make a better growth and more plants will live on low, moist, sandy land than on dry more elevated land; southern blueberry plants will fruit a small amount the second growing season after setting.

There are at least two distinct types of blueberry plants growing wild in the swamps of South Alabama and North Florida, which produce berries that differ very much. There are also many plants which appear from their growing and fruiting habits to be hybrids of these two distinct types.

It may be possible to select out of the blueberry plants growing in South Alabama and North Florida, early, mid-season, and late-ripening varieties, as well as one that ripens over a long period. Some of the southern blueberry plants produce blossoms that are self fertile.

Apple Variety Test, Talladega County. (R. W. Taylor and C. L. Isbell).—This orchard produced its first crop of any importance in 1926, which was the seventh season. The Winesap trees led in average production, closely followed by Red Astrachan and Stayman. The Hackworth produced very little fruit. Disregarding all trees of each variety except such as are healthy and uniform in appearance, Winesap and Golden Delicious trees are the largest.

Pecan Variety Test, Marshall County. (R. W. Taylor and C. L. Isbell).—Trees that were above the average in weight per unit of length when set lived best and have made most growth. Only thirty-five per cent of the trees that lived from the original planting in 1924-1925 grew one foot or more in 1926.

Irish Potato Fertilizer Experiment, Escambia County. (R. W. Taylor and C. L. Isbell).—Complete fertilizers were compared with potash derived from muriate of potash and sulphate of potash, and with nitrogen derived from nitrate of soda, cottonseed meal, ammonium sulphate, and tankage, applied before planting. Sulphate of potash in a complete fertilizer gave greater yields than did muriate of potash. Cottonseed meal as a source of nitrogen gave heaviest yields, followed by ammonium sulphate, tankage, and nitrate of soda in the order named. Probably much of the nitrogen in the form of nitrate of soda was lost by leaching.

Cabbage Fertilizer Experiments, Mobile County. (R. W. Taylor and C. L. Isbell).—A planting was made on each of two farms to determine the influence on yield of a complete fertilizer containing nitrate of soda as a source of nitrogen, of nitrate of soda alone, and of nitrate of soda in combination with acid phosphate. Comparisons were made of the influence on yield of single and of double applications of acid phosphate in a complete fertilizer. Comparisons were made also of influence on yield of muriate of potash and of sulphate of potash in a complete fertilizer, and of the influence of time of application of nitrate of soda.

A complete fertilizer consisting of 1000 pounds of acid phosphate, 1000 pounds of nitrate of soda, and 250 pounds of muriate of potash per acre gave on an average a higher actual yield than did nitrate of soda alone or in combination with acid phosphate. Acid phosphate applied at the rate of 2000 pounds per acre in a complete fertilizer produced a smaller yield than did 1000 pounds. Muriate of potash applied at the rate of 250 pounds per acre in a complete fertilizer gave higher yields than did 500 pounds. Muriate of potash produced higher yields than sulphate of potash. Yields were poor where all the nitrate, in the form of nitrate of soda, was applied before setting. The outstanding plots with respect to time of application of nitrate of soda were those receiving 350 pounds February 1, at which time the plants had six to eight large leaves, and 350 pounds March 1.

Strawberry Fertilizer Experiment, Escambia County. (R. W. Taylor and C. L. Isbell).—In a preliminary experiment set in February 1926, from which no berries were harvested, dried blood as a source of nitrogen resulted in more vigorous plants by June, than did nitrate of soda, ammonium sulphate, or tankage. The difference was not great. No differences in plant growth were observed in the plots fertilized with tankage, nitrate of soda, and ammonium sulphate as the sources of nitrogen.

Strawberry Project. (W. D. Kimbrough).—The objects of this project are to study the effect of the source and rate of application of fertilizer and the time of applying nitrate of soda on yield, grade, quality, and carrying and keeping quality of strawberries.

Missionary plants grown on Norfolk sand seem to require a complete fertilizer to give increased production over check plots. Spring application of sodium nitrate apparently increased the number of blooms in the second bloom. Flower buds producing the second bloom are evidently produced in the spring of the current year.

Results obtained so far indicate that fertilizer treatment has no appreciable effect on the moisture, acid, or sugar content of the strawberry. Sugar content was found to be higher in the second crop of berries than in the first or regular crop.

Respiration determinations showed a little higher rate of respiration in berries from more vigorous plants. Berries kept

at room temperature, as high as 27°C., gave slight indications that those from more vigorous plants would not hold up as long as those from less vigorous plants.

Vegetable Project. (W. D. Kimbrough).—In this project studies similar to those made on strawberries are being made on some of the more important truck crops of the state. Cabbage, potatoes, tomatoes, watermelons and cucumbers are being studied.

Cabbage, potatoes, tomatoes and watermelons show the need of a complete fertilizer on Norfolk sandy soil. On such soil, where sodium nitrate leaches badly, better yields have been obtained with potatoes and cabbage when only part of the sodium nitrate was applied at planting time and the rest as top dressings. Cabbage plants were injured due to acidity of the soil the second year on plots receiving ammonium sulphate and leunasalpeter at rates equivalent to 1000 pounds of sodium nitrate per acre per year.

As yet nothing has been found which would indicate that the quality or keeping quality of the vegetables worked with has been influenced by fertilizer treatment. Judged by taste, as good quality watermelons have been produced on plots receiving heavy applications of nitrate of soda as on plots receiving other sources of nitrogen or on check plots.